CLAIMS

What is claimed is:

1. A sensor system for detecting an object comprising:

a signal source for generating source signal;

an antenna system for transmitting said source signal to and receiving a reflected signal from said object; wherein said antenna system is configured for introducing a phase shift into either said source signal or said reflected signal to create a plurality of signal patterns; and

an information processor programmed to receive said reflected signal and to determine bearing information for said object based on position and phase information in said plurality of signal patterns.

2. The sensor system of Claim 1, wherein said antenna system comprises:

a signal splitter for splitting said source signal into at least a first portion and a second portion;

at least a first antenna for receiving said first portion of said source signal and transmitting a first signal;

at least a second antenna for receiving said second portion of said source signal and transmitting a second signal; and

a phase shifter for switching between providing at least said second portion of said source signal to said second antenna in phase with said first portion of said source signal and shifting at least said second portion of said source signal in phase relative to said first portion of said source signal by a predetermined amount to produce a reference signal pattern and an error signal pattern.

3. The sensor system of Claim 1, wherein said antenna system comprises:

at least a first antenna for receiving said reflected signal and generating a first signal portion based thereon;

at least a second antenna for receiving said reflected signal and generating a second signal portion based thereon;

a phase shifter for switching between providing said second portion of said reflected signal in phase with said first portion of said reflected signal and shifting said second portion of said source signal in phase relative to said first portion of reflected signal by a predetermined amount to produce a reference signal pattern and an error signal pattern; and

a signal combiner for recombining said at least first portion and a second portion into said reflected signal.

4. The sensor system of Claim 2, wherein said first antenna and/or said second antenna comprises at least one antenna array.

5. The sensor system of Claim 1, wherein said signal source comprises:

a signal driver for generating a drive signal;

a pulsed modulator for receiving said drive signal; and

a continuous waves source for generating a continuous wave signal; wherein said continuous wave signal is mixed with said drive signal in said pulsed modulator to generate said source signal for said antenna system.

6. The sensor system of Claim 5, wherein said signal source further comprises a band pass filter filtering said source signal from said pulsed modulator before it is received by said antenna system.

7. The sensor system of Claim 5, wherein said signal source further comprises:

a quadrature power splitter for receiving said reflected signal pulses and for splitting said reflected signal pulses into at least a first reflected signal and a second reflected signal, wherein said quadrature power splitter shifts said second reflected signal in phase by about 90°;

a first mixer for combining said first reflected signal with said continuous wave signal; and

a second mixer for combining said second reflected signal with said continuous wave signal.

8. The sensor system of Claim 7, wherein said information processor is programmed to calculate said bearing information for said object by:

determining a reference amplitude and phase and an error amplitude and phase from said reflected signal;

determining a phase difference between said reference phase and said error phase, said phase difference having a sign of positive or negative, or a phase difference of zero;

calculating said bearing information using said reference amplitude, said error amplitude, and said sign of said phase difference.

9. The sensor system of Claim 1, wherein said information processor comprises a digital signal processor.

10. The sensor system of Claim 1, wherein said predetermined phase difference is a relative phase difference of about 180°.

11. A sensor system for detecting an object comprising:

a signal source for generating source signal;

an antenna system for transmitting said source signal toward said object and receiving a reflected signal therefrom, wherein said antenna system includes:

at least a first antenna for transmitting and/or a first signal portion of said source and/or said reflected signal;

at least a second antenna for transmitting and/or a second signal portion of said source and/or said reflected signal;

a phase shifter for switching between providing said second signal portion in phase with said first signal portion and shifting said second portion in phase relative to said first signal portion by a predetermined amount to produce a reference signal pattern and an error signal pattern; and

an information processor programmed to receive said reflected signal and to determine bearing information for said object based on position and phase information in said reference and error signal patterns.

12. The sensor system of Claim 11, wherein said first antenna and/or said second antenna comprises at least one antenna array.

13. The sensor system of Claim 11, wherein said signal source comprises:

a signal driver for generating a drive signal;

a pulsed modulator for receiving said drive signal; and

a continuous waves source for generating a continuous wave signal; wherein said continuous wave signal is mixed with said drive signal in said pulsed modulator to generate said source signal for said antenna system.

14. The sensor system of Claim 13, wherein said signal source further comprises a band pass filter filtering said source signal from said pulsed modulator before it is received by said antenna system.

15. The sensor system of Claim 13, wherein said signal source further comprises:

a quadrature power splitter for receiving said reflected signal pulses and for splitting said reflected signal pulses into at least a first reflected signal and a second reflected signal, wherein said quadrature power splitter shifts said second reflected signal in phase by about 90°;

a first mixer for combining said first reflected signal with said continuous wave signal; and

a second mixer for combining said second reflected signal with said continuous wave signal.

16. The sensor system of Claim 15, wherein said information processor is programmed to calculate said bearing information for said object by:

determining a reference amplitude and phase and an error amplitude and phase from said reflected signal;

determining a phase difference between said reference phase and said error phase, said phase difference having a sign of positive or negative, or a phase difference of zero;

calculating said bearing information using said reference amplitude, said error amplitude, and said sign of said phase difference.

17. The sensor system of Claim 11, wherein said information processor comprises a digital signal processor.

18. The sensor system of Claim 11, wherein said predetermined phase difference is a relative phase difference of about 180°.

19. A method for calculating bearing information for an object, the method comprising the steps of:

receiving a signal reflected from said object, wherein said signal has a reference signal pattern and an error signal pattern produced by introducing a predetermined phase shift into a portion of said signal;

determining a reference amplitude and phase and an error amplitude and phase from said signal;

determining a phase difference between said reference phase and said error phase, said phase difference having a sign of positive or negative, or a phase difference of zero;

calculating said bearing information using said reference amplitude, said error amplitude, and said sign of said channel phase difference.

20. The method of Claim 19, wherein said predetermined phase shift is about 180°.